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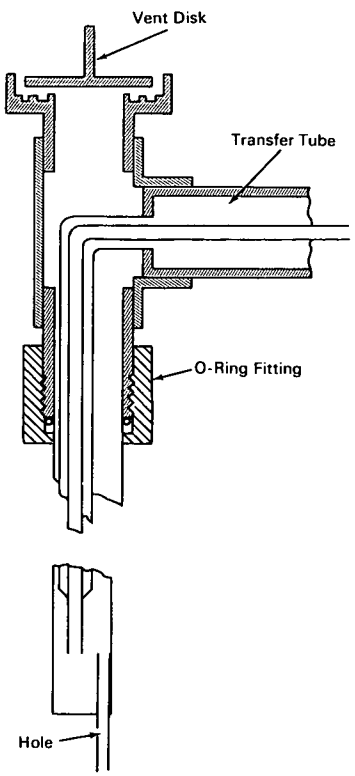
NASA TECH BRIEF

Cryogenic Liquid Transfer System Reduces Residual Boiloff



The problem:

In filling a partially empty dewar with a cryogenic liquid, the warm transfer tube causes the first entering liquid to boil off as gas and this brings about boiloff and raises the temperature of the residual liquid in the dewar. Several liters of fluid can be lost from a relatively small dewar while the transfer tube is cooling. Temperature excursions of up to 40°K may occur in some instances.

The solution:

A system that vents the boiloff to the atmosphere during the transfer tube cooling period, thus preventing boiloff of the residual liquid.

How it's done:

The system incorporates a large-diameter closed bottom tube, extending into the dewar, that permits boiloff of the transferred liquid during the cooling period. The transfer tube terminates near the bottom

(continued overleaf)

of the large tube, adjacent to a final transfer tube extending through the bottom. The top of the large tube is vented to the atmosphere. The entire assembly is installed in the dewar opening by means of an O-ring sealing device.

When cryogenic liquid drops below a hole in the wall of the lower extension of the final transfer tube, transfer is started from the supply source. A vent disk is removed from the large tube and boiloff gas generated by cooling of the transfer tube is vented to the atmosphere. The hole in the lower extension of the final transfer tube prevents the residual liquid from being siphoned into the large tube. When the transfer tube has cooled, liquid collects on the bottom of the large tube and overflows the standpipe portion of the final transfer tube to refill the dewar.

Notes:

1. Using this system, less than one third of the residual liquid was lost in refilling a 3-liter dewar. The temperature change in the residual liquid was 0.02°K at worst and not observable at best through a series of tests.
2. This system is most useful with liquids having very small heat of vaporization such as helium. It is not as useful with liquids with higher latent heat, such as N_2.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio, 44135
   Reference: B66-10157

Patent status:

No patent action is contemplated by NASA.

Source: D. E. Hegland
(Lewis-274)